

FRD Activities Report July 1999



Research Programs

Development of Smart Balloons for Hurricane Research

We have proposed to develop and deploy smart balloons as part of a Lagrangian experiment to better characterize the evolution of the energy content of the marine boundary-layer inflow to hurricanes and its relationship with hurricane intensity changes. This will be a NOAA and NSF sponsored project involving FRD smart balloon and instrument capability and hurricane research at the University of Hawaii.

The development work on the smart balloon will build on previous smart balloon experiments and field projects. New features that are planned for the smart balloons and hurricane research include:

1. A high accuracy aspirated temperature and relative humidity sensor will be installed on the transponder. We will be trying to get a temperature accuracy of better than .5 degrees Centigrade and relative humidity accuracy of better than 3 percent.
2. A light weight precision barometric pressure will be installed to provide absolute barometric pressure accuracy of better than .5 millibar and a resolution of .05 millibar.
3. Differential GPS correction capability will be added to increase the absolute accuracy of the smart balloon altitude. This will be especially important inside a hurricane where barometric pressure is changing fast enough that it cannot be used for altitude calculations.
4. We will work on developing an improved altitude control algorithm. We would like the ability to control altitude within tens of meters rather than the present 100 meters.
5. We will develop and test communications using new low earth orbit satellites to transfer data and control commands between the smart balloons and the ground control station. In the past a radio link between an aircraft in the study area and the balloon have been used for this purpose. The new communications will eliminate the need for an aircraft to gather data.
6. The transponder portion of the smart balloon will be fastened directly to or inside the smart balloon shell. This should help protect the transponder electronics and make launching the balloon easier. (Randy.Johnson@noaa.gov)

BRAVO Tracer Program

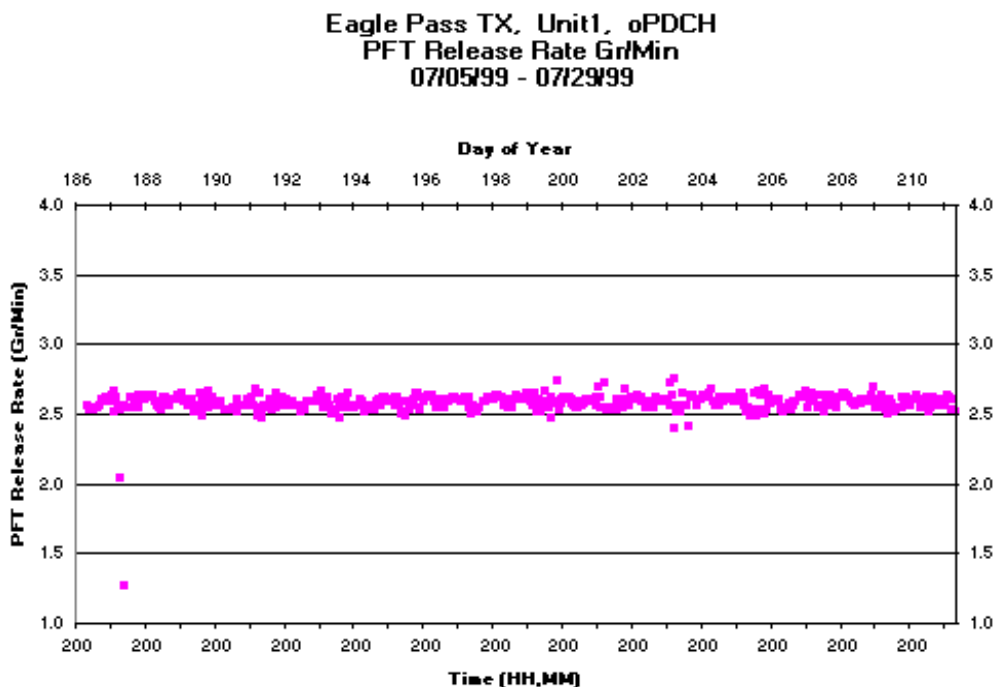
The Big Bend Regional Aerosol and Visibility study (BRAVO) is a field program designed to determine the sources of haze episodes which reduce visibility at Big Bend National Park (BBNP). The cause of these episodes is sulfate aerosol formed from gaseous sulfur emissions which result from

the combustion of coal. The worst periods of visibility degradation occur from July to the end of October. The study is designed to use ambient monitoring, tracer release and sampling, and modeling to identify the sources of the haze.

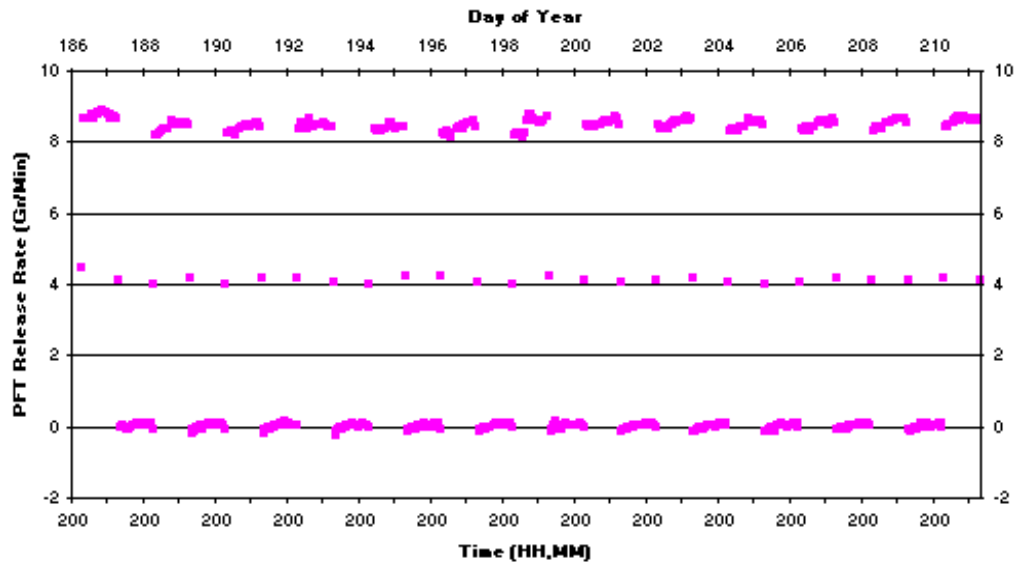
Tracer releases began at a location on the Mexican border, Eagle Pass, Texas, on July 5 at 08:00. Three different perfluorocarbon tracers are being released at this location to identify transport times as well as sources. One tracer will be released continuously. One will be released for twenty-four hours on alternate days, and one will be released from 08:00 to 20:00 every day. Tracer release began from the Big Brown power plant on July 9. Release rates and schedules for each location are:

Location	Eagle Pass	Eagle Pass	Eagle Pass	Big Brown
Tracer	oPDCH	PDCB	PTCH	i-PPCH
Release Rate (kg/hr)	0.155	0.525 alternate days (8am-8am) CDT	0.184 8am CDT-8pm CDT only	0.092

The release rate data are from Units #1 and #2 located at Eagle Pass and are shown below. These plots are updated daily and can be seen at the FRD Bravo website which is found at location <http://www.noaa.inel.gov/frd/Projects/bravo.html>. (Tom.Watson@noaa.gov)



**Eagle Pass TX, Unit2, PDCB
PFT Release Rate Gr/Min
07/05/99 - 07/29/99**



AFTAC Non-proliferation Tracer Study

A final report was prepared for the AFTAC study. Three chemicals were released in April and May in a series of seven tests to support the Molecular Collection Analysis-Chemical (MCA-C) Program. The report included INEEL mesonet data, MDIFF model output, tracer release data, tracer analysis data, and supporting synoptic scale data including visible and infrared satellite images and surface, 850, 700, and 500 mb NCEP analyses. (Kirk.Clawson@noaa.gov, staff)

Upper-Air Climatological Support for Proposed Space Port

Efforts are continuing to develop various upper-air climatological products that will support the INEEL as well as the proposed space port. Monthly and annual summary wind profiles were prepared from the 915-Mhz profiler and RASS data. These data will be used by space port personnel to analyze areas where debris from potential explosions may fall. They will also be used to determine the impact of potential ducting of ground-based and airborne explosions, should such an event occur. (Kirk.Clawson@noaa.gov, Jerry Crescenti, Neil Hukari)

Cooperative Research with INEEL

Sagebrush Steppe Ecosystem Reserve

On 17 July, DOE Secretary Bill Richardson and Idaho Governor Dirk Kempthorne created the Sagebrush Steppe Ecosystem Reserve on the INEEL DOE reservation. (See: <http://www.inel.gov/cgi-bin/newsdesk.cgi?a=89&t=template.html>.) The Reserve sets aside 74,000 acres of pristine sagebrush steppe for scientific research. The sagebrush steppe ecosystem covers approximately 94 million acres of the 11 western states. The creation of the Reserve comes at a very advantageous time because we are in the process of setting up a year-round carbon dioxide and water vapor flux monitoring site in this very ecosystem. We are collaborating with scientists from the USDA/ARS in this CO₂ monitoring effort. The sagebrush steppe ecosystem has largely been ignored by researchers trying to understand the carbon balance of the earth. This has become an increasingly important area of study with the signing of the Kolbe, Japan accord which will reduce U.S. CO₂ emissions to 1990 levels. With the equipment we will be installing, we will be filling the information gap on sagebrush steppe ecosystems. (Kirk.Clawson@noaa.gov)

Cedar Butte Range Fire

On 20 July a rare Idaho tornado touched down near Pocatello. A semi-truck was tipped over and several automobiles were damaged. The same weather system spawned a lightning storm that caused the Cedar Butte range fire near the southern INEEL site boundary. The Emergency Operation Center (EOC) was activated and Jerry Sagendorf and Dianne Hoover were called in to represent NOAA. By late evening the fire was deemed under control and the EOC operations were suspended for the night. The next evening the fire jumped the fire line and spread onto the INEEL site. The EOC was again activated with minimum staff representation. Jerry Sagendorf was called in to support EOC operations until near midnight and again the following morning in the EOC until it was determined that the fire no longer threatened the INEEL. The Cedar Butte fire eventually consumed about 40,000 acres of range land but no damage was incurred to INEEL facilities. The INEELViz system was once again very helpful for providing timely wind condition information to those fighting the fire. (Jerry.Sagendorf@noaa.gov, Dianne Hoover)

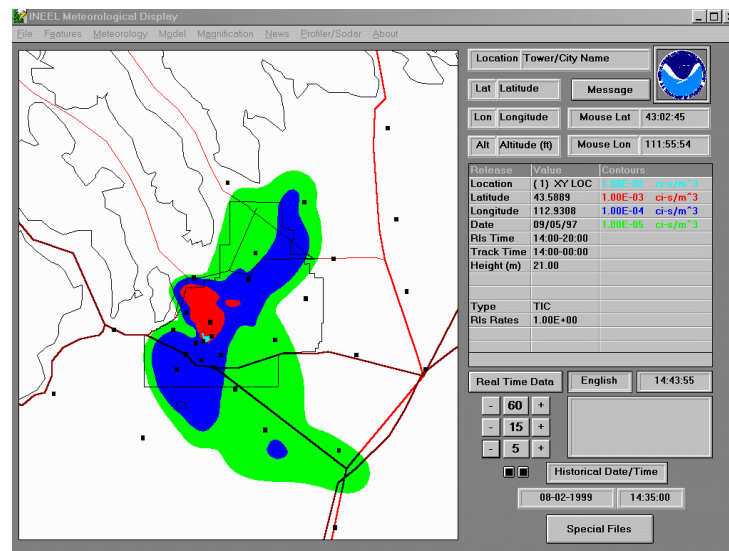
Wind Forecast System

The automatic wind forecast system for the INEEL mesonet has been reconfigured to generate a forecast every 30 minutes. Previously, it was running once per hour, but our experiences with the AFTAC project in April and May indicated that more frequent runs would be beneficial. The system uses an historical pattern matching technique and generates a two hour wind forecast with a typical run time of between two and three minutes. (Roger.Carter@noaa.gov)

INEELViz Display

INEELViz (shown below with output from an MDIFF dispersion model calculation) has been modified to use the data from the wind forecast model described above. Using the data, operators

can generate short term plume projections from 1 ½ to 2 ½ hours. In addition, a snapshot feature was added to the model output, showing the current plume location rather than the cumulative footprint.



An autorun feature was also added, allowing the plume projection to update automatically as new wind field data is received. Changes to FRD's web site are being made to supplement the information provided by INEELViz by including meteorological data from our 31 station mesonet. (Brad.Reese@noaa.gov)

Y2K Operability

The 915-MHz radar wind profiler and the SODAR located on the INEEL were checked for Y2K operability. Both successfully collected and stored data with the computer clocks set to the year 2000. One minor software change was required in the system that stores the profiler data and has been implemented. To read more about our 915 MHz profiler and Rass systems visit [http://www.noaa.inel.gov/news \(1/1/99\)](http://www.noaa.inel.gov/news (1/1/99)). (Roger.Carter@noaa.gov, Jerry Cresenti)

FRD's LAN upgrade from a Netware based network to an NT based network was completed, making all systems Y2K compliant and providing staff the ability to access all network resources remotely. (Brad.Reese@noaa.gov)

Modeling Impacts

Work is continuing on modeling impacts from a number of INEEL facilities. The results will be included in a database that will allow one to examine them on a monthly, seasonal, or annual basis. This database will be used by both INEEL contractors and the State of Idaho INEEL Oversight Committee to select specific areas and seasons for locating their air sampling stations. (Jerry.Sagendorf@noaa.gov)

Advanced Mixed Waste Treatment Plant

Plans are in place at the INEEL to install the Advanced Mixed Waste Treatment Plant (AMWTP). This plant will process mixed waste before it is moved from Idaho to a permanent storage site. Residents of the resort area of Jackson Hole, WY are expressing concern about the impact this plant may have on them. Wind roses from surface meteorological stations, monthly and annual summary wind profiles from the 915-MHz profiler and RASS data, and the MDIFF modeling results have been provided for use to help alleviate the fears of the residents. Explanations of wind flow patterns were also provided to Idaho State Oversight personnel for inclusion in a fact sheet on the AMWTP. (Jerry.Sagendorf@noaa.gov, Kirk Clawson)

Cluster Analysis

The identification of natural clusters in southeast Idaho wind fields has been completed for the years 1996, 1998, and a combined data set. 1996 and 1998 both showed the same 7 natural clusters that were present in the 1994 and 1997 data sets. The combined set used 32,630 data points from the 64 month period of Oct 1993 to Feb 1999. It showed eight natural clusters. The additional cluster appeared to be a division of the largest of the seven clusters occurring in the annual data sets. The analysis will be repeated including one additional station.

We have also implemented several trial forecasting tools based on the cluster analysis. The frequency of occurrence of each cluster type by month and time of day has been mapped. A graphical display of the distance of the current wind field from each cluster center allows visualization of the wind field transition from one cluster to another. We are also working on probabilities of transition from one cluster to each of the other clusters. All of these show potential as possible tools to aid in the forecasting of wind field changes in southeastern Idaho. (Roger.Carter@noaa.gov, Neil Hukari)

Atomic City Meteorological Station

Work is progressing on acquiring permission to install a new meteorological monitoring station at Atomic City, which lies on the boundary of the INEEL. Permission for an easement from the city to put a power line under a road into the pasture where the tower will be located is being considered by the city council. A lease for the pasture has been offered by MASC real estate, and is being reviewed by the landlord. (Kirk.Clawson@noa.gov, Paula.Fee)

Big Southern Butte Meteorological Station

A meteorological station on Big Southern Butte as an addition to the INEEL mesonet is being contemplated. The data would be used to verify and validate the winds measured from the radar profiler, which is in the vicinity of the butte. The BLM has been approached about this matter and will consider our request after the appropriate paper trail is in place. (Kirk.Clawson@noaa.gov, Roger Carter)

Introductory Meteorology Short Course Taught at INEEL Emergency Response Seminar

On 15 July, the FRD meteorological staff presented a seminar to the INEEL emergency response organization. The topics taught included: 1) The Role of NOAA/FRD in INEEL Emergency Response, by Kirk Clawson, 2) General Circulation and Horizontal Winds, by Jerry Crescenti, 3) Stability, Vertical Motion, Basic Diffusion and MDIFF, by Jerry Sagendorf, 4) and INEEL Prevailing Wind Patterns, by Neil Hukari. Brad Reese also presented an update on INEELViz, the FRD-developed meteorological display software which now boasts 50 installed sites. The attendees responded enthusiastically to the new and planned developments in INEELViz. They were also impressed with the data presented by Jerry Sagendorf on the excellent correlation of calculated concentrations of SF₆ from MDIFF to actual data acquired during the AFTAC field experiment in April and May. Most of all, they were surprised to learn that the most commonly observed wind field on the INEEL site is not southwesterly, but rather northwesterly. This was derived from the recent cluster analysis on INEEL winds performed by Roger Carter on the INEEL mesonet. (Kirk.Clawson@noaa.gov, staff)

New DOE COR

A meeting was held on 29 July with Betsy Jonker, our new DOE COR and Eddie Chew's replacement. Kirk Clawson reviewed FRD's progress on DOE projects during the last quarter. The topics included the following:

- Cluster analysis
- Wind profiler repair
- Alternate repeater site
- EOC participation
- Next gen INEELViz
- AFTAC tracer/MDIFF comparison
- Pattern matching forecasting
- E field sensors
- Atomic City met station
- CO₂ flux site

Betsy was impressed at our accomplishments and passed on compliments she received from work we have performed for other DOE colleagues. (Kirk.Clawson@noaa.gov, staff)

Emergency Operations Center Support (EOC)

On July 12, 1999, a small rodent entered a power substation on the INEEL causing a short circuit and subsequent fire which resulted in a power failure at one of the facilities. The Emergency Operations Center (EOC) was activated to deal with potential problems associated with the loss of power to key systems at the facility. Roger Carter and Neil Hukari responded to the EOC as the FRD representatives. (Roger.Carter@noaa.gov, Neil Hukari)

Due to roof repairs at the INEEL Emergency Operations Center (EOC), the satellite dish for the EMWIN system was removed. The EMWIN system is a back-up source of national weather service

text products for EOC operations. The dish will be reinstalled as soon as the repairs are completed. (Roger.Carter@noaa.gov, Brad Reese)

INEEL Meteorological Network

Last February, the repeater for the radio network used to collect data from the INEEL mesoscale meteorological network failed due to ice damage on the antennas. Temporary repairs were made after traveling to the mountain top on snowmobile. (Pictures and story found at <http://www.noaa.inel.gov/news> 2/24/99). On July 15, 1999, the temporary antenna cable at the repeater failed causing us to lose all data collection capabilities. The problem was compounded because the backup repeater would not work reliably. The repeater antenna cable was replaced on July 16 and all data from the outage period were successfully collected. Troubleshooting on the backup repeater is underway. (Roger.Carter@noaa.gov)

New Design for Profiler Support System

Last month, major structural damage to the supports for the 915MHz radar profiler antennas was discovered. We have designed a new support system and are beginning construction on it. We hope to have the profiler back in operation in a few weeks. (Roger.Carter@noaa.gov, Jerry Cresenti)

Other Activities

NRC Site Visit

Dr. Judith Nyquist, Deputy Director and Program Administrator Associateship Programs for the National Research Council (NRC), visited FRD on July 13. The site visit agenda included detailed discussions presented by several members of FRD's staff. Tim Crawford presented an overview of FRD and its mission, while Kirk Clawson discussed the important role FRD fills for the INEEL. Tom Watson presented his research interests in tracer dispersion monitoring and modeling, as well as analytical chemistry techniques. Jerry Cresenti discussed the importance of ground-based remote sensor research for the acquisition of upper-air meteorological data to be used for air quality modeling. Tim Crawford presented his research on airborne measurements from small aircraft. Dr. Nyquist has responded favorably to our request to be included in NRC's research program. Tim Crawford's NRC advisor status is being transferred from ATDD to FRD. In addition, we are pleased to report that Tom Watson and Jerry Cresenti have been approved as new NRC research advisors. We are now actively seeking a NRC Postdoctoral Research Associate. (Tim.Crawford@noaa.gov)

LongEZ

FRD staff (Tim Crawford, Jeff French and Jerry Cresenti) are working with ATDD personnel (Ed Dumas and Rick Eckman) on the preparation of the LongEZ for two upcoming experiments. The first experiment known as CASES, will be conducted in Kansas during October. This field study will examine the behavior of the nocturnal boundary layer. The second experiment, SHOWEX, will be conducted off the coast of Duck, North Carolina from November 10 to December 10. The primary

objective of SHOWEX was to measure the spatial and temporal variation of the mean wind, surface stress, and spectral wave fields in the coastal shoaling zone and to develop new models for the drag coefficient and momentum transfer between waves and the atmosphere. The mobile flux platform (MFP) data acquisition system and sensors are being tested before installation of the LongEZ. We expect rigorous inflight tests in August to assure reliable operation of the MFP. (Tim.Crawford@noaa.gov, Jeff French, Jerry Crescenti)

FRD Education Outreach

FRD is coordinating with the State of Idaho INEEL Oversight Program and the Shoshone-Bannock Indian Tribes on a meteorological educational outreach effort. This committee is focusing on the dissemination and use of meteorological and radiation data from the four Idaho Environmental Monitoring kiosks in southeast Idaho. The data are available both in person at each kiosk and over the Internet (see <http://oversite.inel.gov>), helping to make visitors aware of the meteorological support FRD provides to the INEEL and the general public. A public relations officer (Alana Jensen) has been hired by the State of Idaho. Her responsibility will be to finish the workbook for middle and high school teachers. The workbook will acquaint students with meteorology derived in real-time (with input from the committee). She will publicize the outreach efforts of the three groups in the local media and at state-wide teacher inservice seminars. In addition, the Idaho Environmental Monitoring Workbook is near completion. A critical review of the document was provided by several FRD scientists. This workbook will be distributed to the various schools in southeastern Idaho as part of the continuing outreach effort. (Kirk.Clawson@noaa.gov, Jerry Crescenti)

Robert Leviton Award

The AMS Measurements Committee, chaired by Jerry Crescenti, has recently provided a critical review of four *Journal of Atmospheric and Oceanic Technology* papers written by students. The titles and authors of these papers are: *Improved installation procedures for deep layer soil moisture measurements* by J. B. Basara and T. M. Crawford; *Convective boundary layer height measurement with wind profilers and comparison to cloud base* by A. W. Grimsdell and W. M. Angevine; *Optimized operation and calibration procedures for radical amplifier type detectors* by C. M. Mihele and D. R. Hastie; and *Gravity wave spectra from GPS/MET occultation observations* by A. K. Steiner and G. Kirchengast. The committee has made a recommendation to the AMS Awards Committee to bestow the Robert Leviton Award to one of these students. Unfortunately, the name of the winner can not be disclosed at this time until the AMS Awards Committee has formally approved the Measurements Committee's recommendation. It should also be pointed out that the Robert Leviton Award was not granted last year because of a lack of student papers dealing with meteorological instrumentation and/or observation techniques. (Jerry.Crescenti@noaa.gov)

New Employees

We are pleased that Dr. Jeffrey R. French has joined the FRD team on 19 July as a Physical Scientist. Jeff comes from the University of Wyoming where he completed a Ph.D. in Atmospheric Sciences. He also has degrees in Physics and Meteorology. (Tim.Crawford@noaa.gov, Paula Fee)

Travel

Tom Watson, Randy Johnson, Shane Beard, James Angell and Darrell Hanni traveled to Eagle Pass and Big Brown, TX June 13-July 10, 1999, to install four (4) tracer release systems for the Big Bend Regional Aerosol and Visibility study (BRAVO).

Shane Beard traveled to Eagle Pass and Big Brown, TX July 25-29, 1999 to conduct a QA audit on the 4 release systems and refill the bulk release tanks for the BRAVO study.

Visitors

On 15 July, the division hosted representatives from the State of Idaho Oversight Program and the Shoshone-Bannock Indian Tribes for a demonstration of the Airborne Geosciences program. The LongEZ was on display in the shop area and capability discussions were also held. The LongEZ always generates curious inquiries whenever it is shown. (Kirk.Clawson, staff)

